Collaboration and analytics for optimal production and forecasting

Tom Fox, dynamicforecaster.com

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Digital Energy Journal Forum on

Using analytics to improve production

Summary

- To maximise production we need to integrate different areas of technical expertise. We need to involve all levels in the organisation, asset equity partners and customers too.

- Integrated activity planning, rolling production forecasting and asset management must be aligned.
  For credible production forecasting, we have to reach a balanced view of uncertainties.

- How can we enable such collaboration across organisations and locations?

- Integrated Operations Centres are not the whole answer.
  People, Process, Technology and Organisation all need yet more attention to deliver improved workflows.

- A case-study of optimising gas-lift for many wells will show the benefits of collaboration for understanding the reservoir, production and facilities all brought together with insights from Operations.

From analytics to forecasts

Understanding the past, using analytics,

helps to forecast future production

When we have analytics,

- Who understands them?
- How will we use them?

It's a bad time to be poor at planning and forecasting

Challenges

- Low oil price
- High unit costs of mature offshore fields
- Aging platforms and pipelines infrastructure

i.e. *commercial*, *production* and *maintenance*

Opportunities

- Lucrative production enhancements
- Share infrastructure to reduce unit costs
- Extending field life defers cost of abandonment

Collaborative analytics & forecasting

From analytics to better forecasts

Challenges in planning and forecasting

Impact of problems

What is needed to improve forecasting?

Design of collaborative analytics & forecasting

Implementation examples

Forecasting depends on complex planning

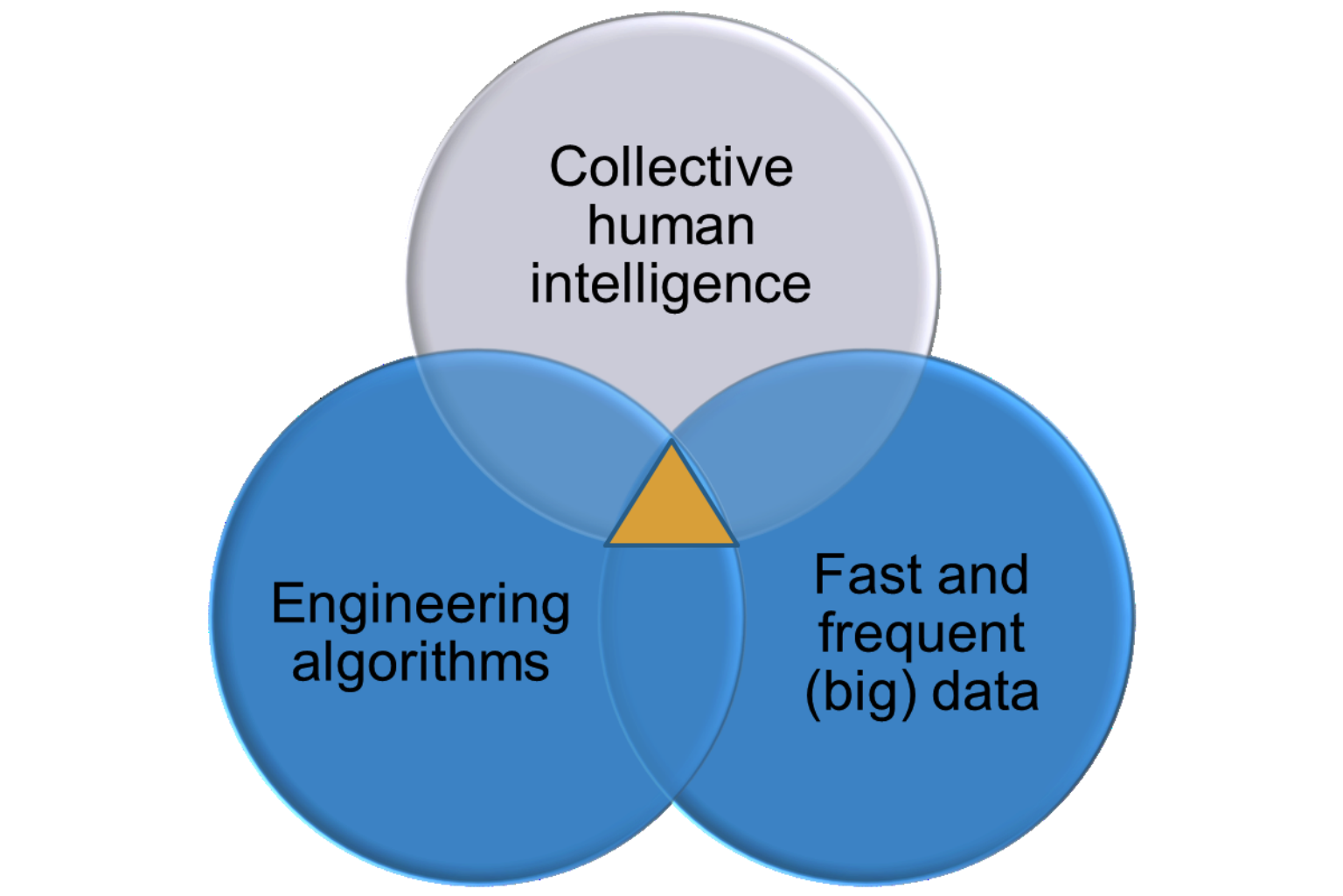
Integrated Activity Planning

- **Commercial** cash flows
- **Production** flows
- **Maintenance** logistics

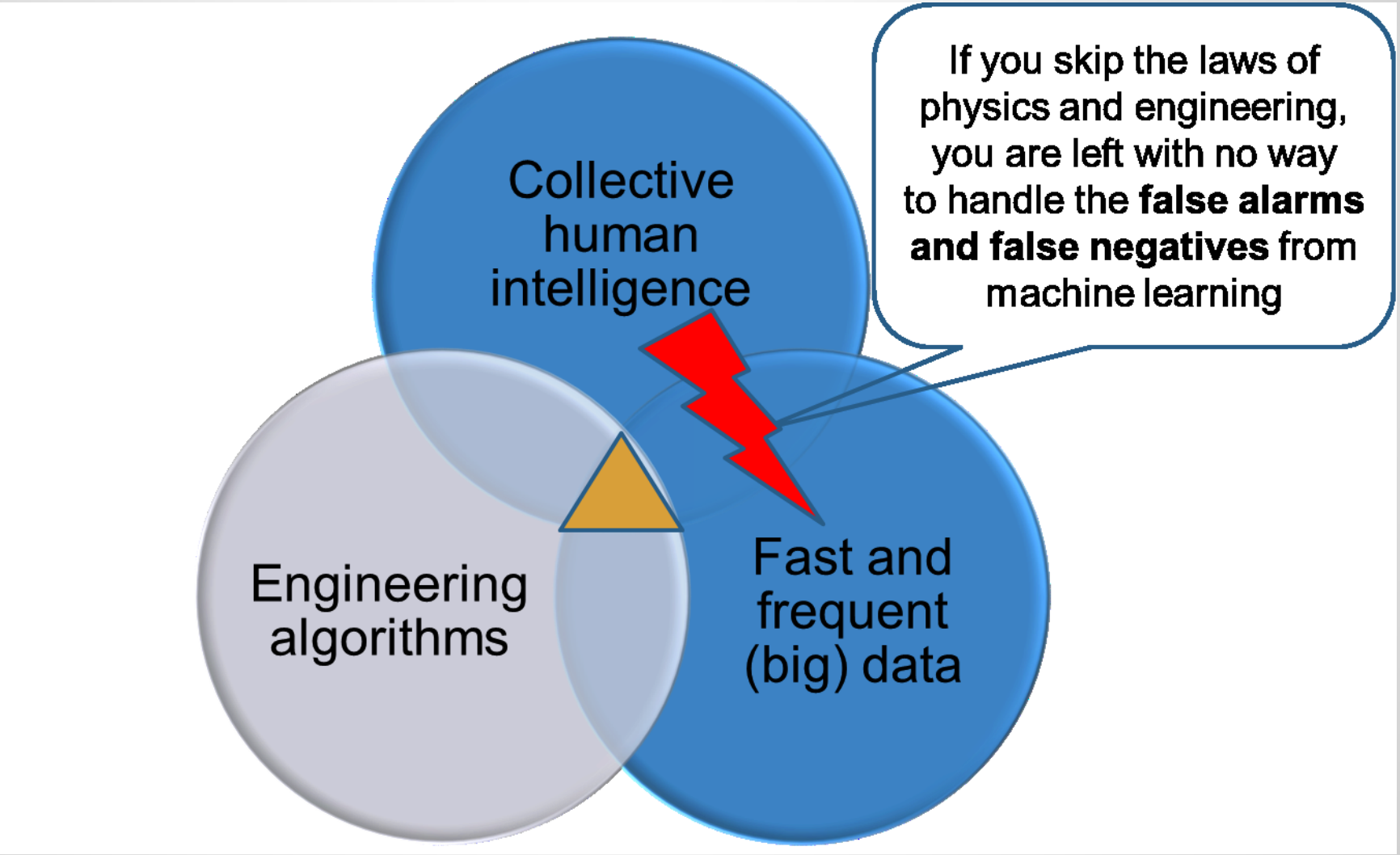
but …

- **Complex decisions** are hard
- **Implementation** easily breaks down

A digital solution is an incomplete solution



Overloaded with misleading conclusions



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Quiz: Who can identify this …

- ~10% of North Sea oil and gas production
- An offshore production platform; a system node
- Unusually operating in ‘phase 1 mode’
- Maintenance Permit(s) to Work, e.g. PSV #504
- Hydrates in the gas compression system pipework, so stopped condensate pump B.
- Urgently started condensate pump A …
- Disaster
- US$1.4 billion insurance claims
- 167 lives lost in July 1988

We have not forgotten Piper A …

Copyright image is accessible from the link below

http://www.bbc.co.uk/news/uk-scotland-22840445

https://enwikipediaorg/wiki/Piper_Alpha

Missing integrated management

- ~10% of North Sea oil and gas production
- An offshore production platform; a system node
- Unusually operating in ‘phase 1 mode’
- Maintenance Permit(s) to Work, e.g. PSV #504
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- Urgently started condensate pump A
- Disaster
- US$1.4 billion insurance claims
- 167 lives lost in July 1988

maintenance

production

commercial

Psychological traps impair decisions

- **Over-relying on first thoughts: the anchoring trap**
- Keeping on keeping on: the status quo trap
- Protecting earlier choices: sunk–cost trap
- **Seeing what you want to see: the confirming–evidence trap**
- Posing the wrong question: the framing trap
- Being too sure of yourself: the over-confidence trap
- Focusing on dramatic events: the recall-ability trap
- **Neglecting relevant information: the base-rate trap**
- Slanting probabilities and estimates: the prudence trap
- Seeing patterns where none exist: the out-guessing randomness trap
- Going mystical about coincidences: the surprised-by-surprises trap

Ref. Hammond, Keeney, & Raiffa, (1999). Smart Choices

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Collaboration is not a luxury

It deserves purposeful investment
of your time, energy and money

Collaboration on analysis

- Software to provide shared access to analysis
  - inputs
  - tools
  - results
- Integration of analysis
  - Multi-discipline expertise
  - Multi-role (operators, analysts, management, partners, vendors, customers).
  - Multi-location
  - Concurrent more than sequential

Communications are not a luxury

Everyone makes decisions

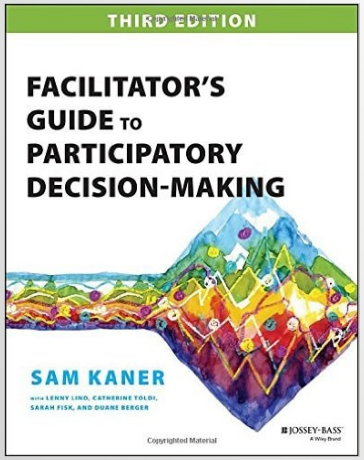
at all levels in your organisation.

- Why not keep them informed?

- How can they participate in complex decisions?

Gradients of agreement

is a better vocabulary than
'Yes/No'
for team decision-making



Team Decision Making Gradients of Agreement

Yes

Enthusiastic Support

1. Fully support - *"I like it."*
2. Endorsement with minor concerns - *"Basically I like it."*

Lukewarm Support

3. Agree with reservations - *"I can live with it."*
4. Abstain - *"I have no opinion."*
5. Stand aside - *"I don't like this, but I don't want to hold up the group."*

Meager Support

6. Disagreement, but willing to go with majority - *"I want my disagreement noted, but I'll support the decision."*
7. Disagreement, with request not to be involved in implementation - *"I don't want to stop anyone else, but I don't want to be involved in implementing it."*

Strong Objection

8. Can't support the proposal

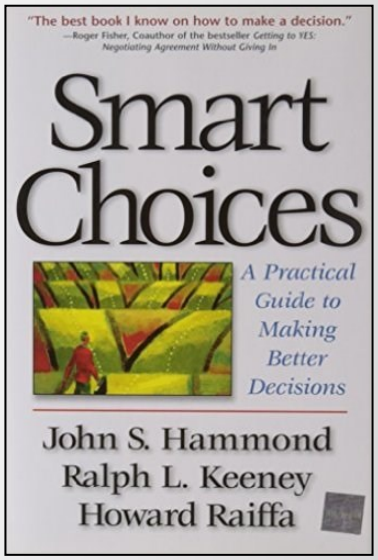
No

Source: Community at Work Gradients of Agreement Scale, 1996

Smart choices: a practical guide to better decisions

ProACT

- Work on the right decision **Pr**oblem
- Specify your **O**bjectives
- Create imaginative **A**lternatives
- Understand the **C**onsequences
- Grapple with your **T**rade-offs
- Clarify your uncertainties
- Think hard about your risk tolerance
- Consider linked decisions
- Be aware of psychological traps



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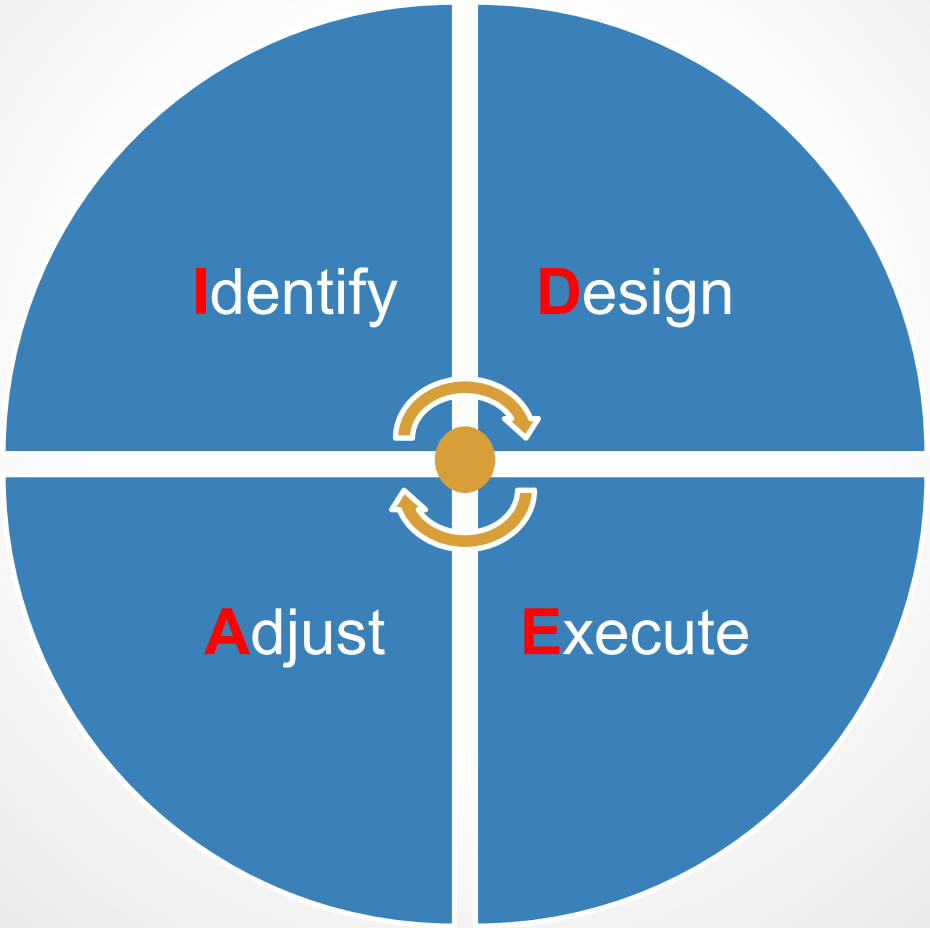
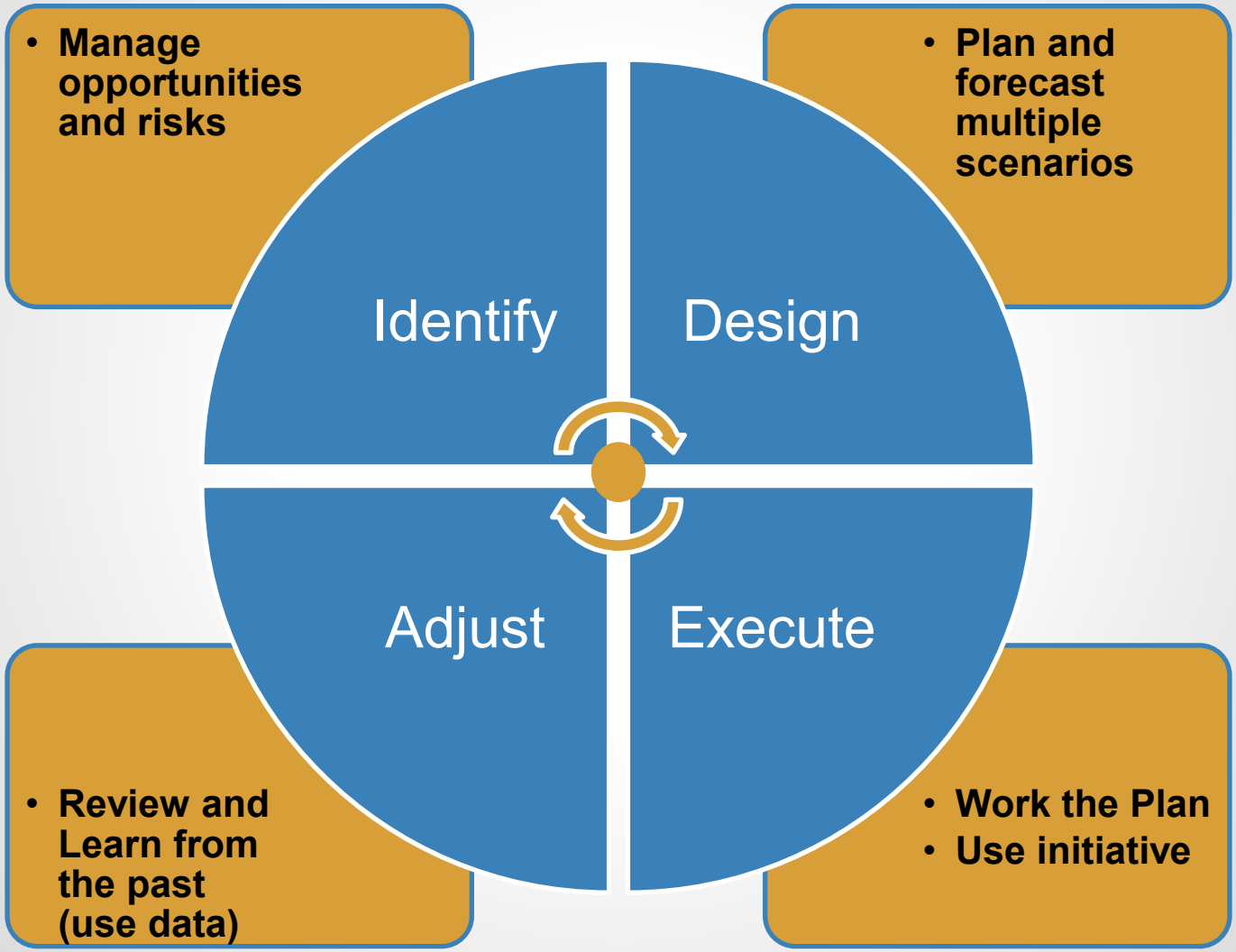
‘IDEA’ cycle of improvement



Ref. May (2007) The Elegant Solution: Toyota’s Formula for Mastering Innovation

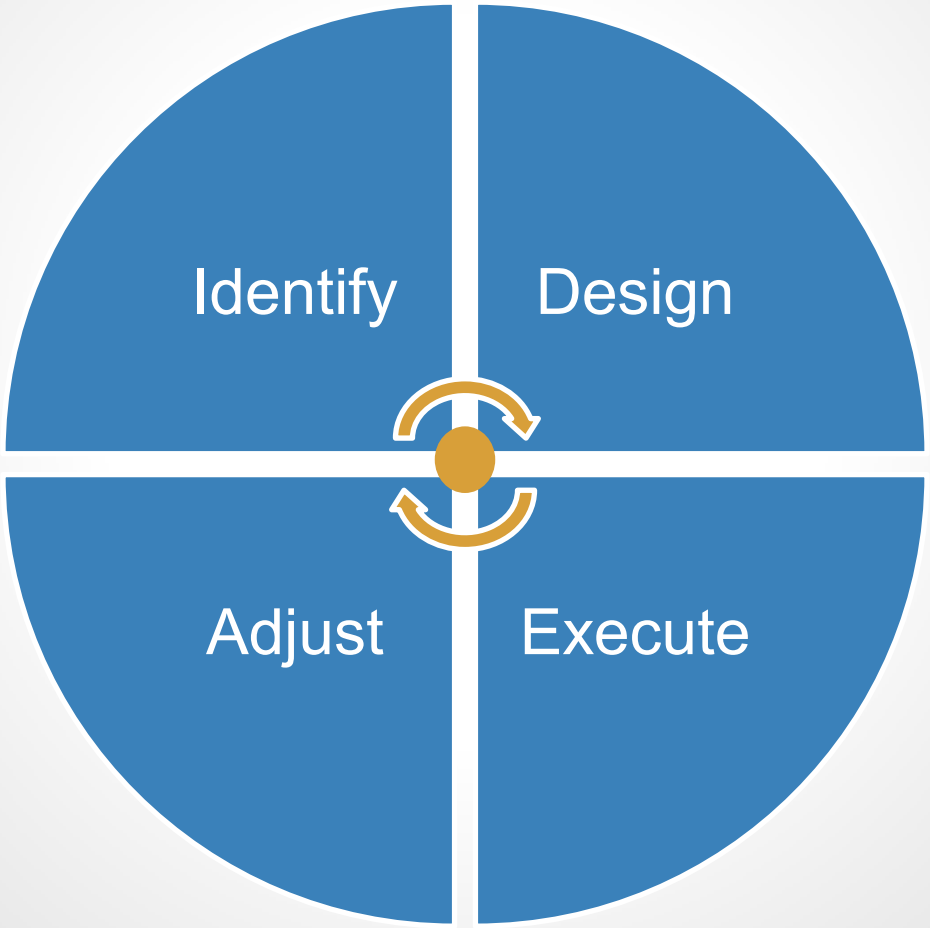
Primary processes for forecasting



Collaborative events in planning cycle

‘Produce the Limit’ workshop

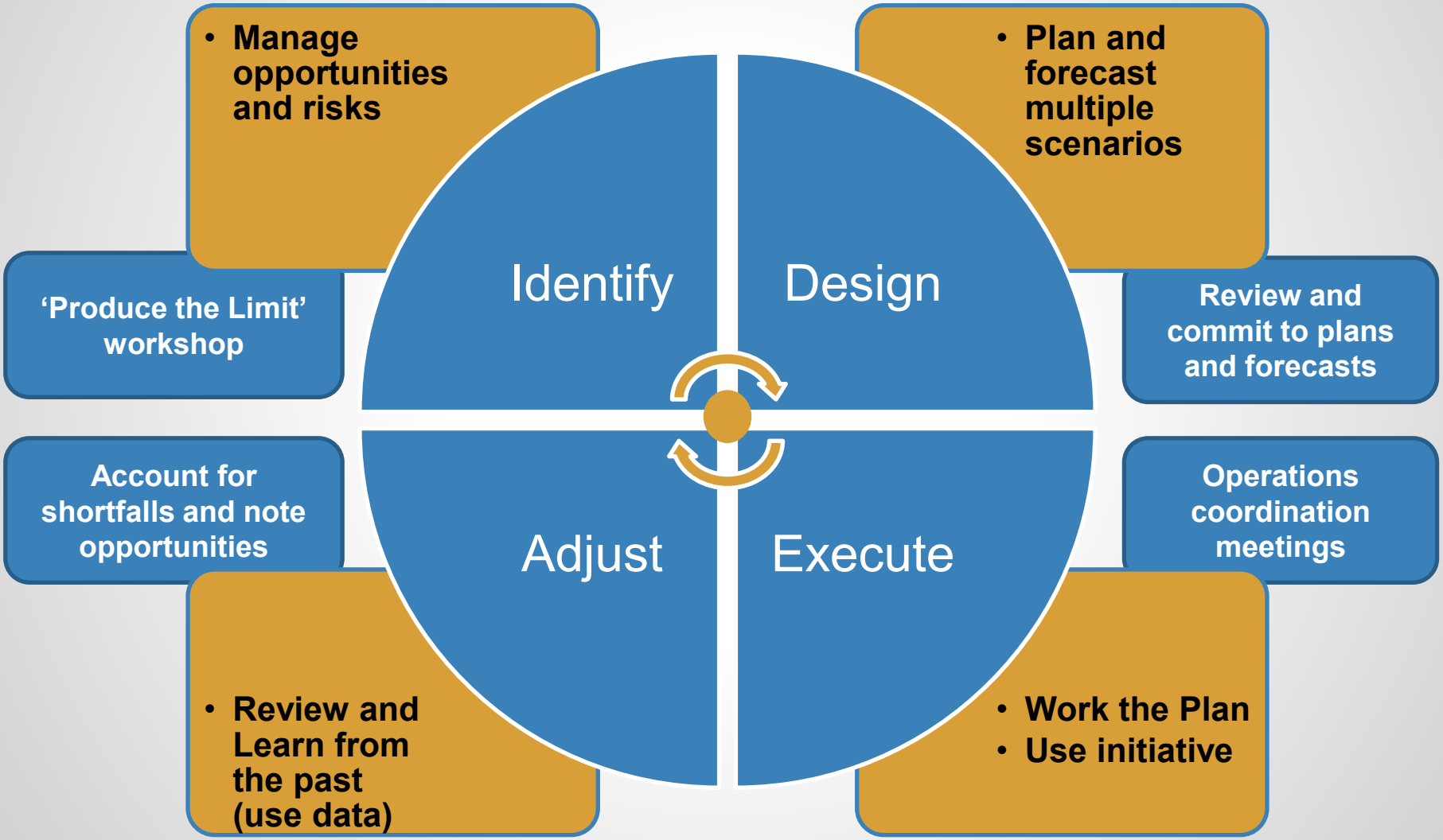
Account for shortfalls and note opportunities



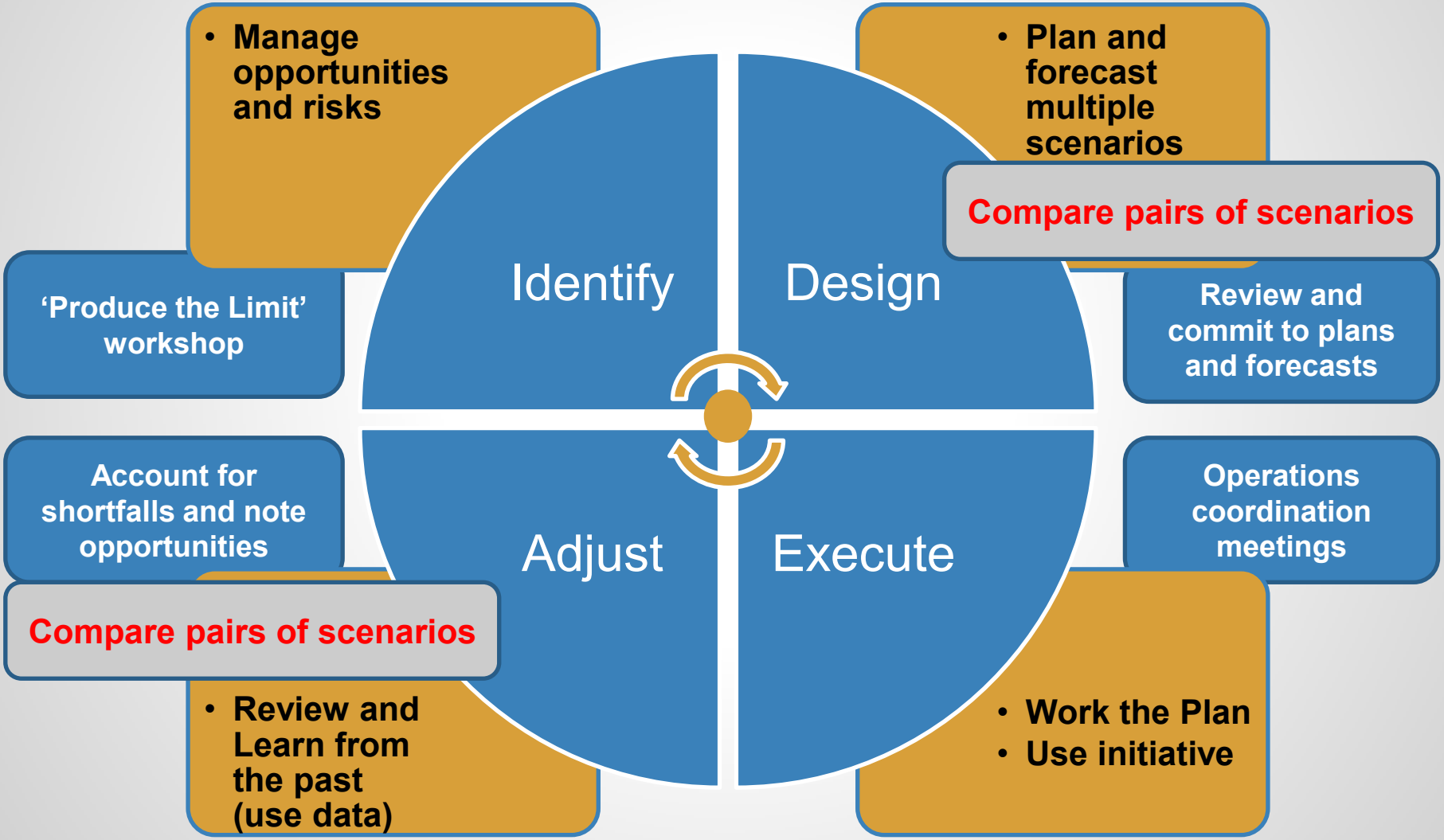
Review and commit to plans and forecasts

Operations coordination meetings

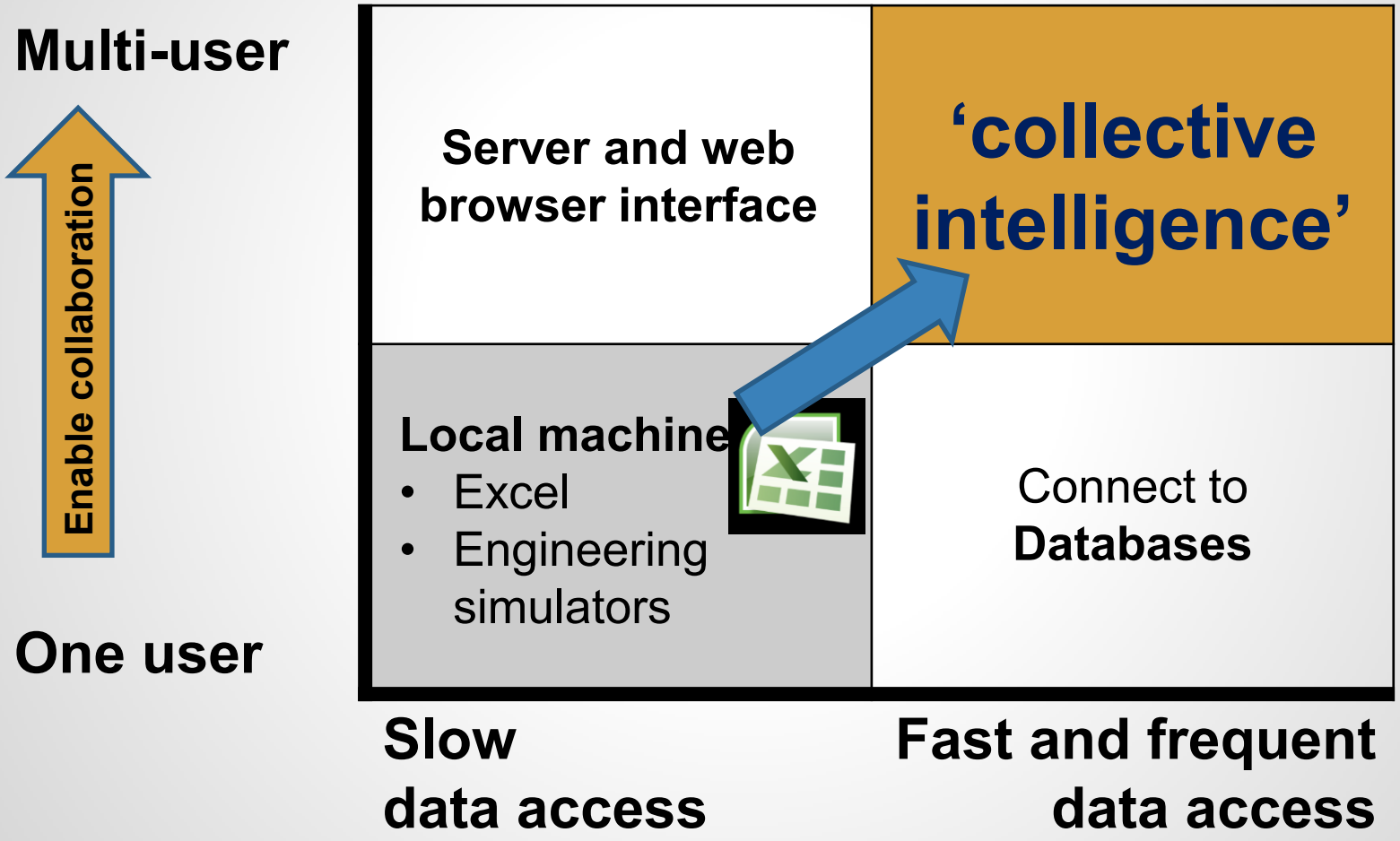
Collaborative analytics & forecasting



Collaborative analytics & forecasting

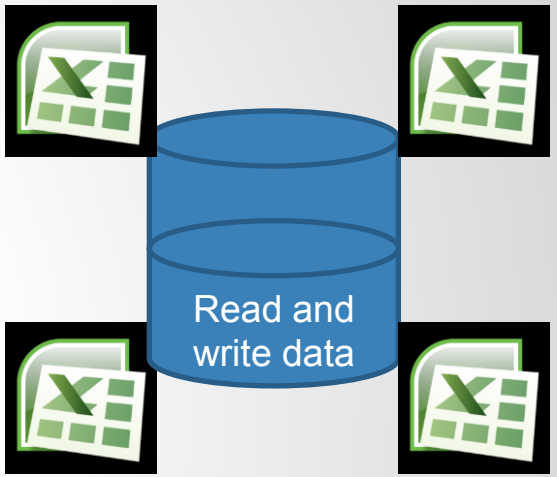


Team access to analysis tools & data



Why move beyond spreadsheets?

- Error rate is unacceptable (refs.1,2)
- Hard to enforce version control
  - VBA coding is difficult to adapt
- Lack of security for multiple users
- Poor for rolling, repetitive updates
- Risk of bad business decisions



	DateTime	TOTAL	Total_A	A_001	A_002	A_003	A_004	A_005	A_006	A_007	A_008	A_009	Total_B	Total_C	D_Total	E_Total	F_Total
3	2013-01-01	216	45	1	2	3	4	5	6	7	8	9	27	54	90	45	45
4	2013-01-02	216	45	1	2	3	4	5	6	7	8	9	27	54	90	45	45
5	2013-01-03	216	45	1	2	3	4	5	6	7	8	9	27	54	90	45	45
6	2013-01-04	216	45	1	2	3	4	5	6	7	8	9	27	54	90	45	45
7	2013-01-05	216	45	1	2	3	4	5	6	7	8	9	27	54	90	45	45
8	2013-01-06	216	45	1	2	3	4	5	6	7	8	9	27	54	90	45	45
9	2013-01-07	252	45	1	2	3	4	5	6	7	8	9	27	54	126	45	81

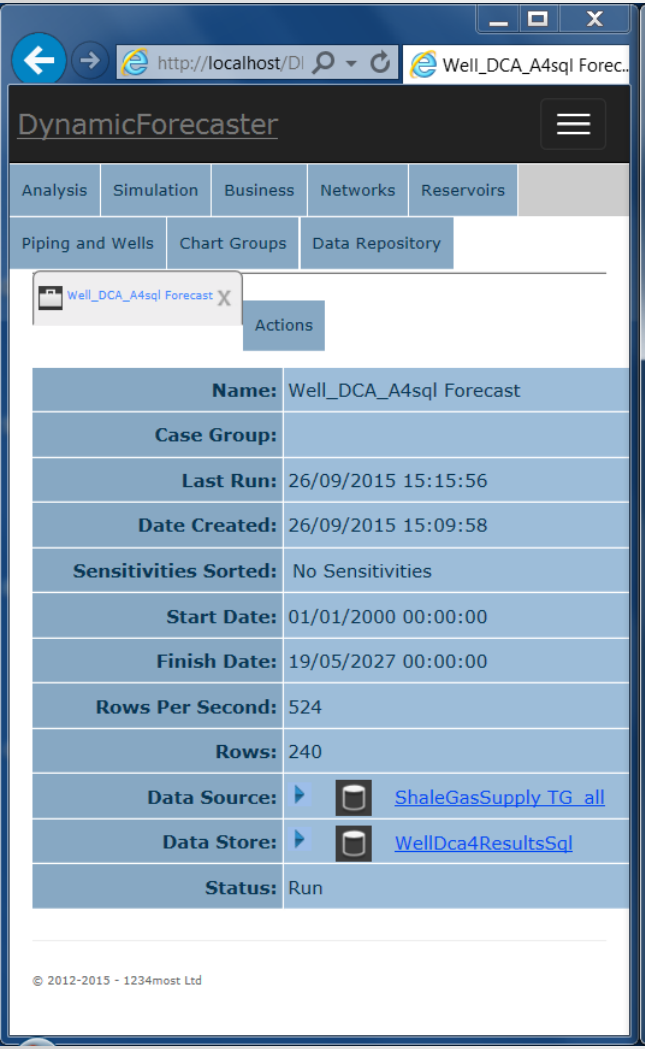
Flows | Events | summaryFlows | Sheet3

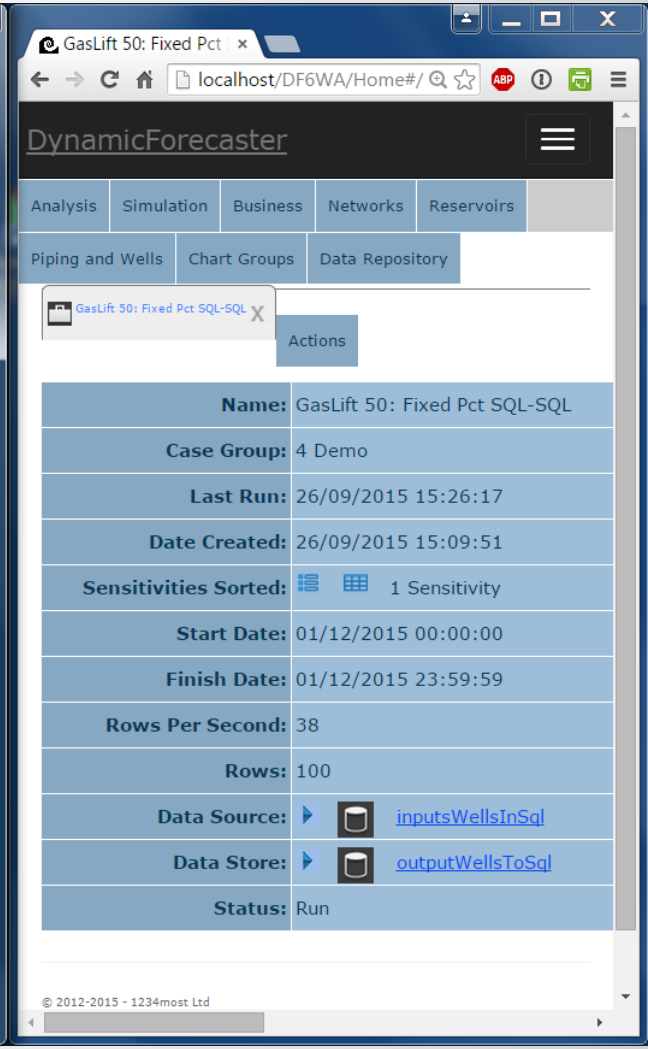
1. http://panko.shidler.hawaii.edu/SSR/Mypapers/whatknow.htm
2. http://www.eusprig.org/horror-stories.htm

Implementation examples

DynamicForecaster, a multi-user, web-enabled analytics solution for collaboration on both production analysis and forecasting

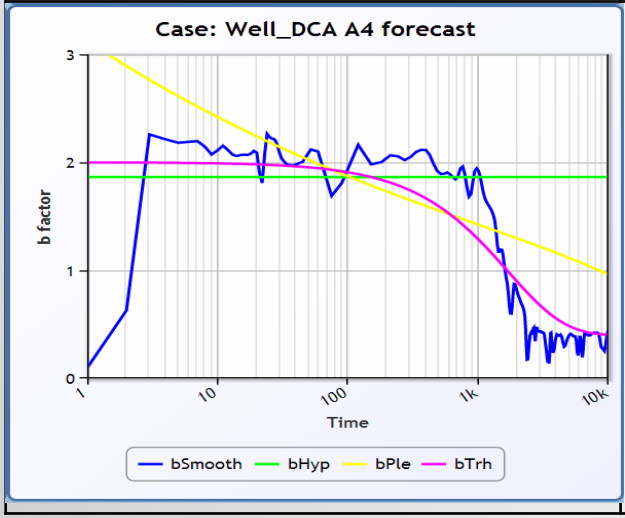
Multiple users can run analyses

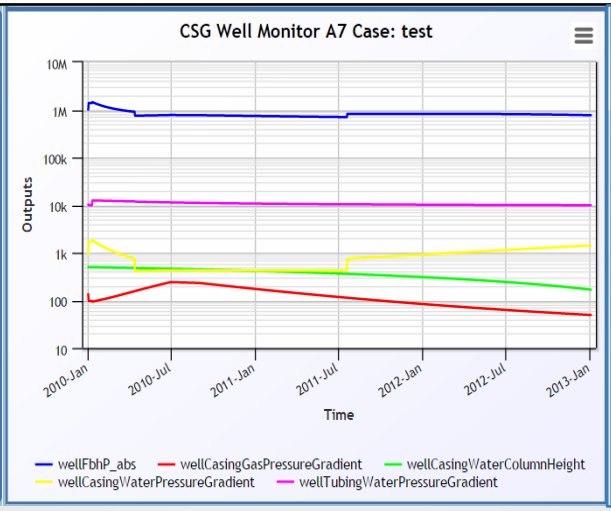


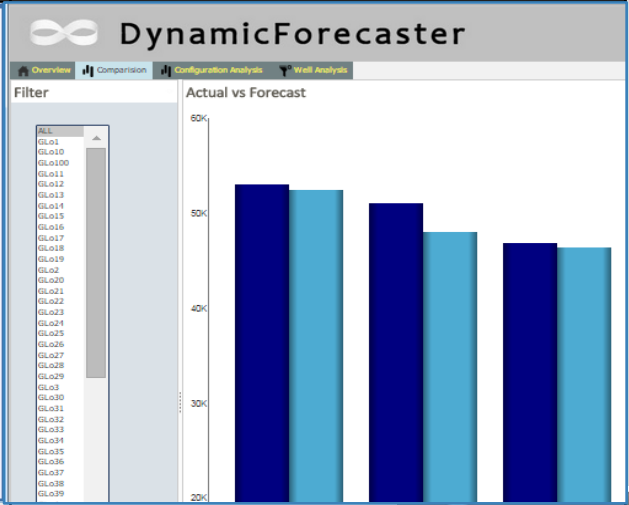


Versatile for analytics & optimized forecasts

Well forecasting	Virtual metering	Optimized scenarios
Shale Gas wells	**Coal Seam Gas wells**	**gas-lifted Oil system**
Optimal curve-fit of 4 * DCA models and then forecasts each	Computes F.B.H.Pressure and pump performance vs. expected	Computes max. oil from optimized gas-allocation for 100 wells
4 scenarios * 240 rows	1 scenario * 1100 rows	8 scenarios * 100 rows * 12 m
2 seconds (SQL-calc-SQL)	1 second (SQL-calc-SQL)	70 seconds (SQL-calc-SQL)







DynamicForecaster is fast with Excel I/O

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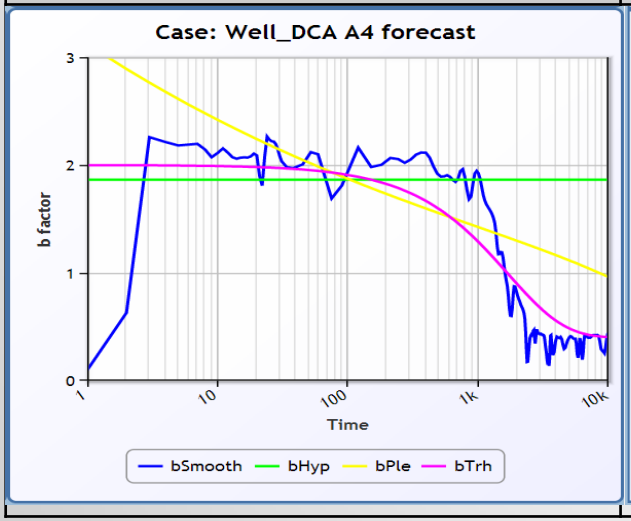
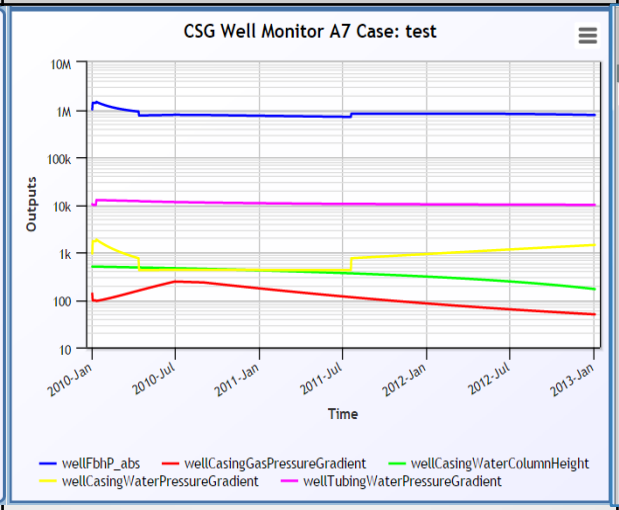
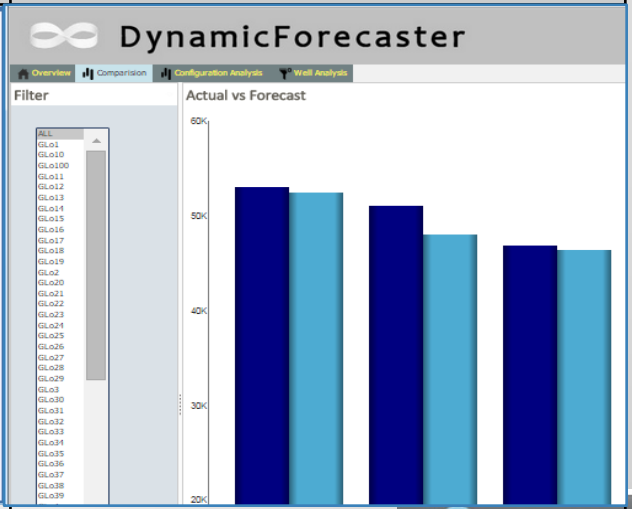
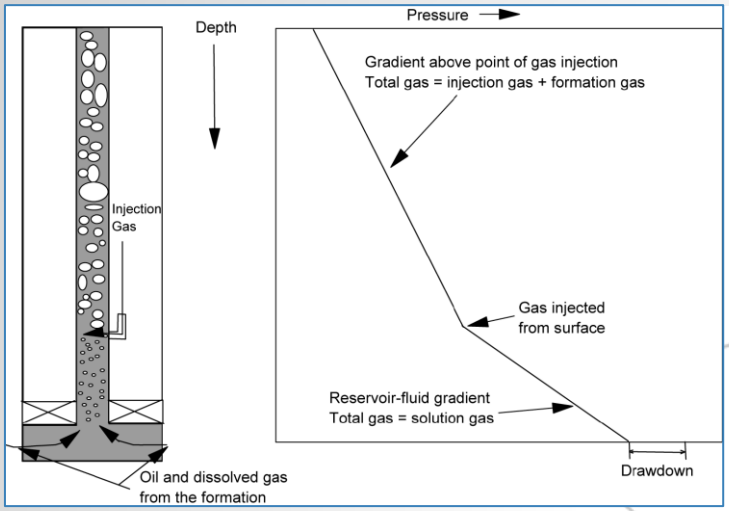
6 s 11,000 cells to Excel	**2 s 30,000 cells to Excel**	**6 s 10,000 cells from Excel**

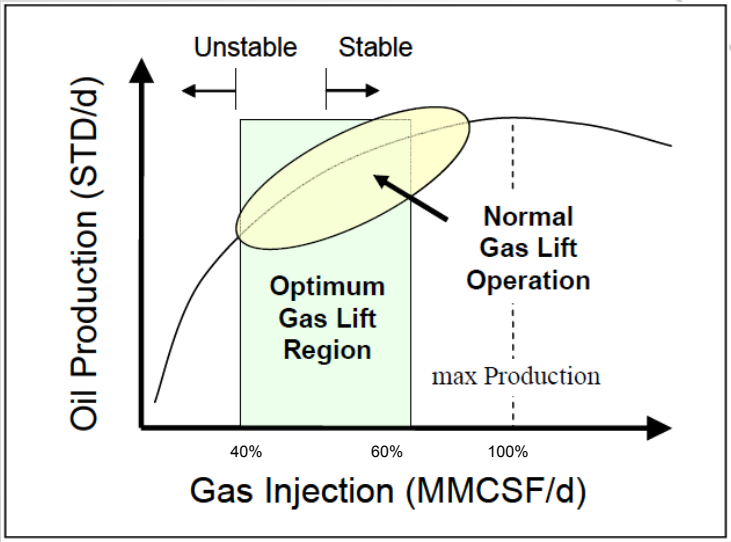


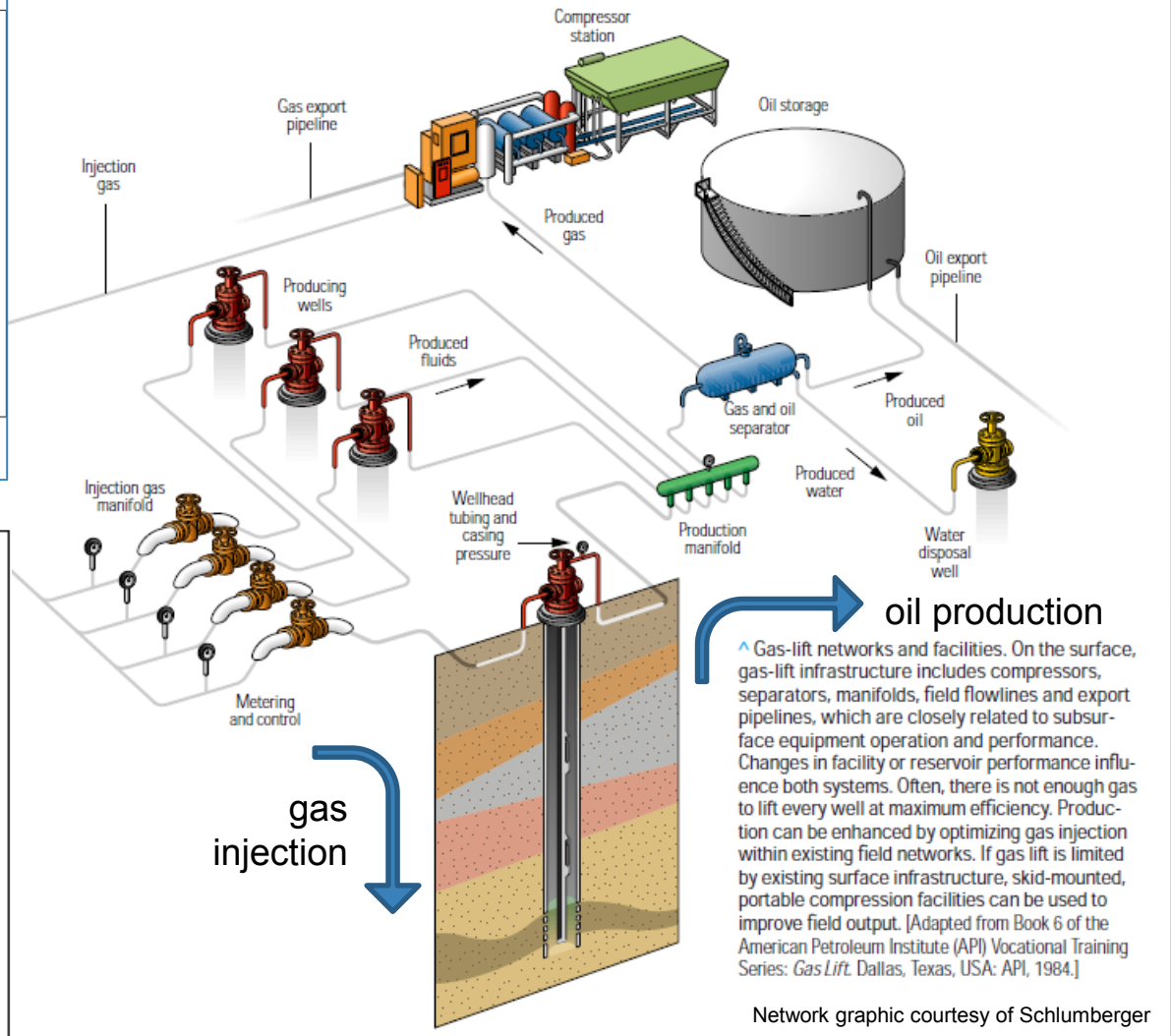




Oil wells: maximise oil production by optimised allocation of gas-lift supply





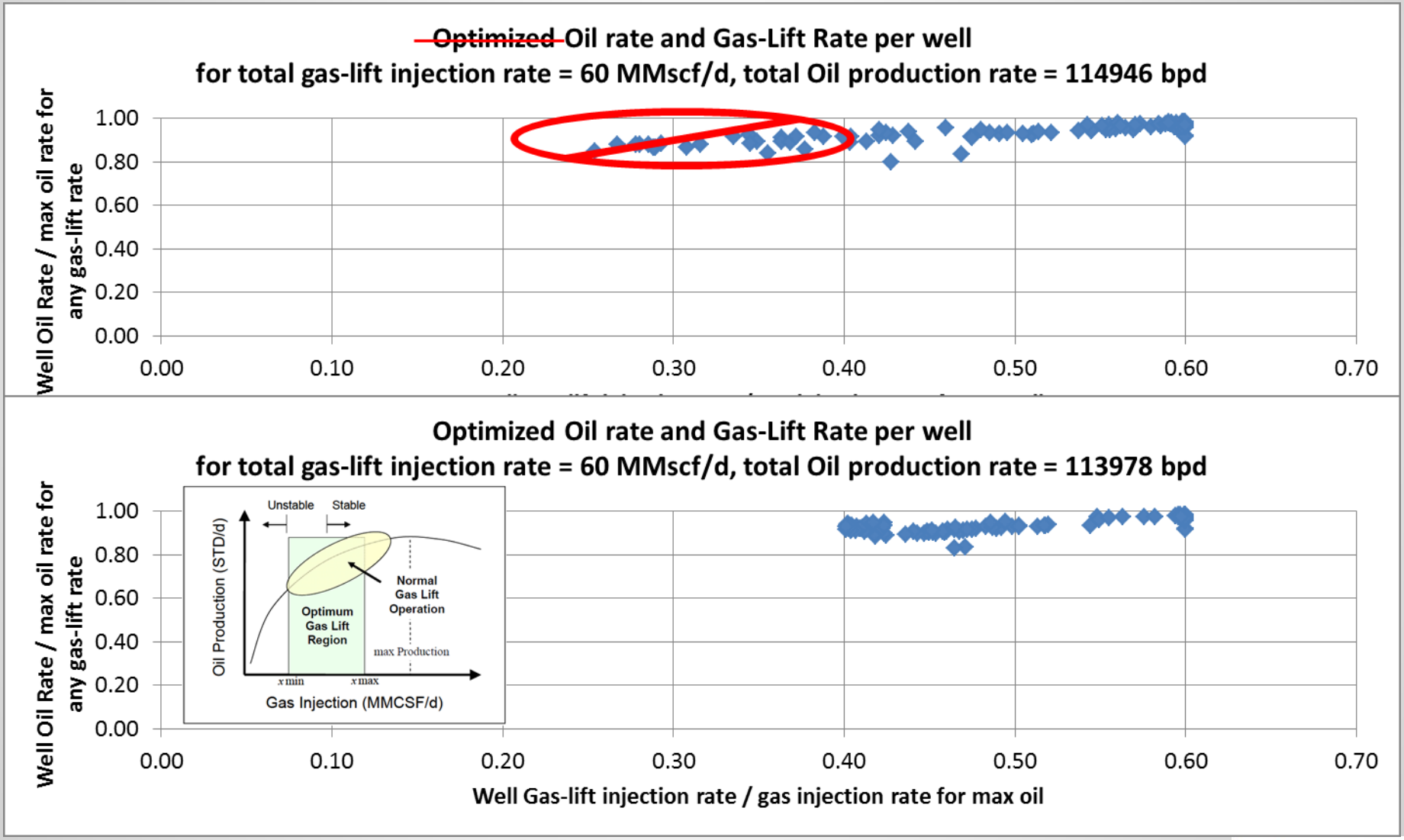


^ Gas-lift networks and facilities. On the surface, gas-lift infrastructure includes compressors, separators, manifolds, field flowlines and export pipelines, which are closely related to subsurface equipment operation and performance. Changes in facility or reservoir performance influence both systems. Often, there is not enough gas to lift every well at maximum efficiency. Production can be enhanced by optimizing gas injection within existing field networks. If gas lift is limited by existing surface infrastructure, skid-mounted, portable compression facilities can be used to improve field output. [Adapted from Book 6 of the American Petroleum Institute (API) Vocational Training Series: *Gas Lift*. Dallas, Texas, USA: API, 1984.]

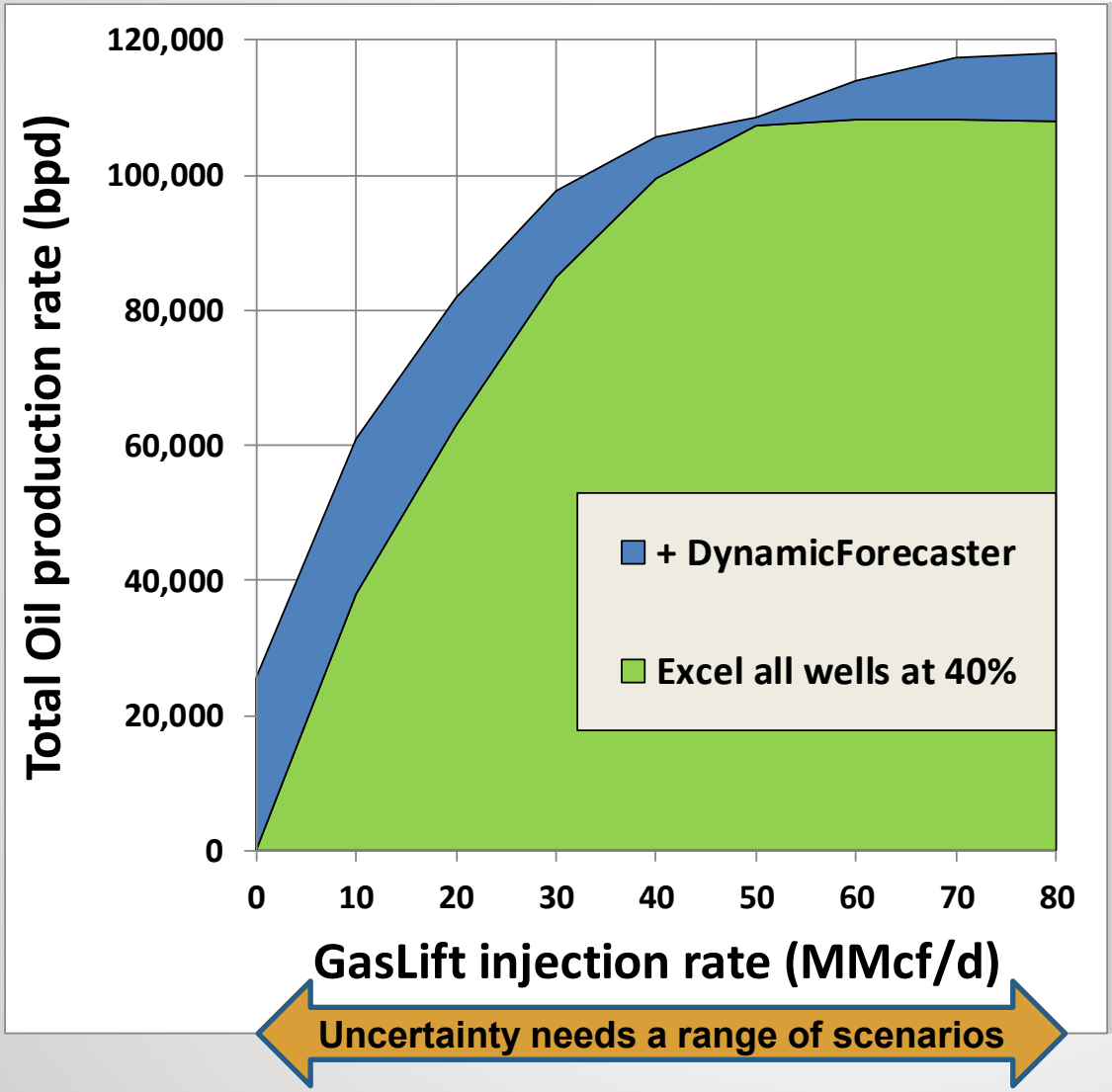
Network graphic courtesy of Schlumberger

http://support.sas.com/resources/papers/proceedings11/195-2011.pdf

Oil wells: optimised allocation of gas-lift supply



Value-added by gas-lift optimisation



How to allow for future uncertainty in the total gas supply?

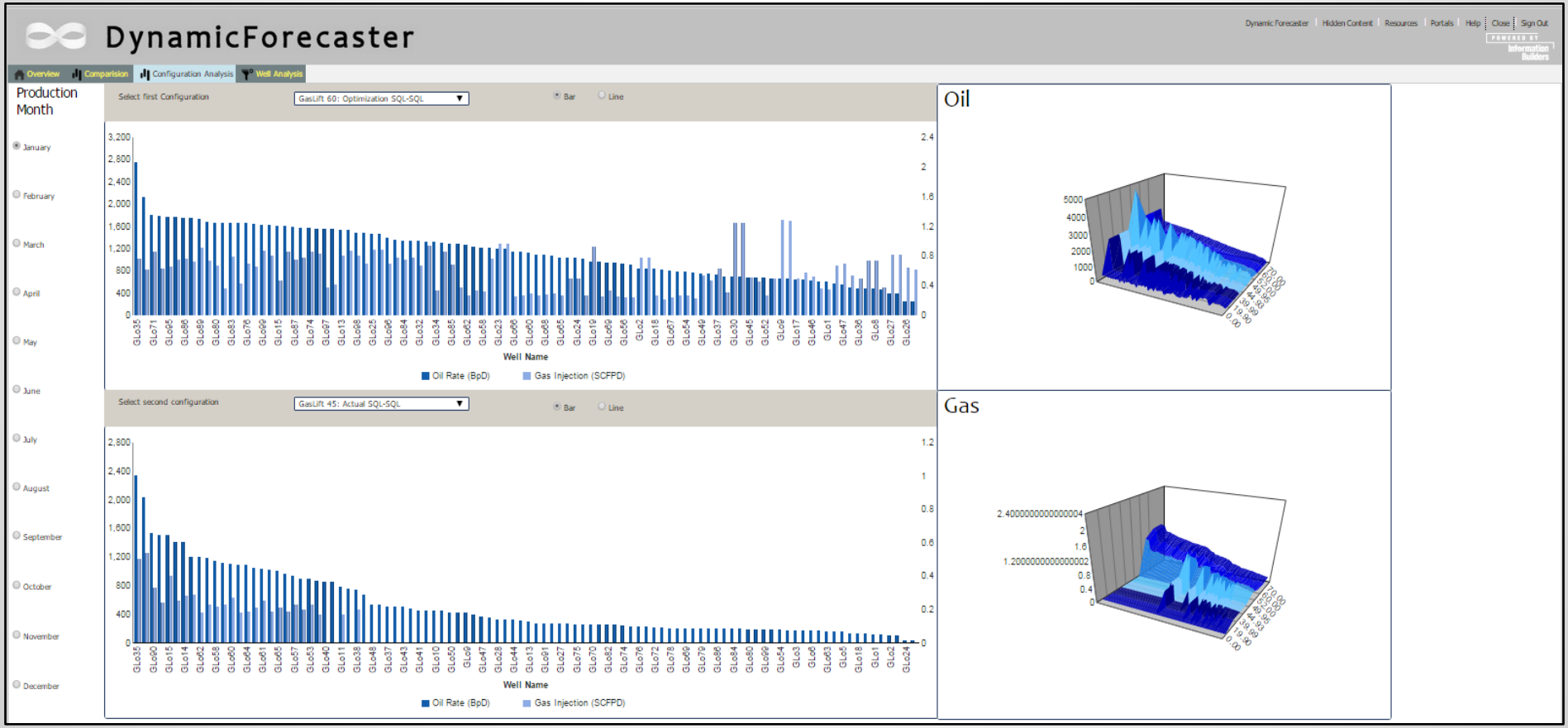
DynamicForecaster computes several *optimised* scenarios (at 0, 20, 40, 50, 60, 70 MMscf/d).

Baseline: operators are given the 40% of peak well injection gas rate for every well (perhaps from Excel)

Incremental oil should be valued at the NPV of *accelerated* production

DynamicForecaster with WebFOCUS by Information Builders

Web portal for actual production data compared with optimised gas-lift forecasts for 100 wells, 8 scenarios, monthly*12



http://www.informationbuilders.co.uk/products/intelligence

DynamicForecaster © 4most

Collaborative analytics & forecasting

Challenges in planning and forecasting

- Integrate commercial, production and maintenance

Impact of problems

- Don’t have a disaster

What is needed to improve forecasting?

- Collaboration defends against psychological traps

Design of collaborative analytics & forecasting

- Processes and events for continuous improvement

Implementation examples

- Well forecasting, virtual metering, gas-lift optimisation
- High value from optimised forecasts with multiple scenarios

Know sooner, decide better, act faster